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Assessment of waste amalgam management in dental clinics in Ramallah and al-Bireh cities in Palestine

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The behavior of dental health personnel was examined with regard to the handling and proper disposal of wastes generated at common dental clinics, and some of the amounts of waste they produce were estimated. In January 2002, a random sample of 37 dental clinics was chosen in the cities of Ramallah and al-Bireh. The visited clinics were distributed between 31 private practices and six public/NGO dental clinics. The dentists were asked about the methods they follow in disposing and discarding of amalgam wastes. An average dentist is estimated to place two small, seven medium and nine large amalgam restorations releasing 22.6 grams of mercury each week. The majority of amalgam wastes ended up in trash or drain.

Keywords: Amalgam; dental waste; management; developing countries; Palestine.

Introduction

The major hazardous wastes that are produced at dental clinics include dental amalgam restorations, X-ray wastes, chemical disinfectants, sharps as well as blood soaked dressings (EPA 2000). Amalgam has been widely used, by dentists, as a dental filling material for over 100 years (Eley 1998). Amalgam fillings consist of 1 : 1 mixture of metallic mercury and an alloy powder of silver, tin or copper. Its content of mercury has created a long-term debate regarding its use until today. Besides its known effects on health, mercury creates an important environmental impact that should be dealt with (Dental Recycling North America) (DRNA 2000).

The mercury in amalgam can be released into the environment through various channels, mainly air, water, and solid waste (NCDPP 2001). It is worth mentioning that the metallic mercury in amalgam is considered relatively non-toxic. However, when it is released into the environment, certain species of bacteria may convert part of it into methyl mercury, which is known to be a potent neurotoxin (NCDPP 2001). Furthermore, the amalgam, when it is mixed with general waste that is incinerated, will cause the mercury to volatilize and enter the atmosphere (National Wildlife Federation 1999). In addition, the discarded amalgam waste that ends up in landfills may lead to soil and water contamination (National Wildlife Federation 1999). Dental clinics are also responsible for the mercury content in wastewater, since the amalgam particles that are rinsed down the drain or escape the poorly maintained

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chair side dental unit traps and filters reach eventually the wastewater (National Wildlife Federation 1999). A pollution prevention agency in the Bay Area in California pointed out that a small sized filling (which was considered as one unit) contains 0.55 g of mercury (Emerging Infections Program (EIP) 2000; Barron 2001). Similarly, a medium filling of two units would contain about 1.10 g of mercury.

In the Palestinian context, data is not available regarding the number of the newly placed amalgam fillings or even the removed old restorations in dental clinics. No local study is available about the individual practices of dentists in their dental offices, and whether they try to minimize the effects of mercury released within the waste of these fillings. This data presented in this paper investigates these issues especially in the absence of health regulations and law (Al-Khatib 2002).

Materials and methods

The study was carried out during the month of January 2002, through field visits to the various randomly selected dental clinics, where structured interviews were conducted with the dentists using a pre-prepared questionnaire. The interviews lasted from 20 to 30 min.

The total number of registered dental clinics in Ramallah district in the year 2001 was 106, distributed between public/Non-governmental Organizations (NGO) and private sectors (Palestinian Dental Association 2001). Of these 106 clinics, 94 are found within the borders of Ramallah and al-Bireh towns; 86 of them are private, and eight clinics belong to public institutions or NGOs (Governmental (Gov) – NGO's – charitable and United Nations Relief and Works Agency (UNRWA). The 12 remaining clinics are registered in the rural surroundings.

This study focused on the clinics within the urban centres only, because of the difficulties faced in reaching the rural areas due to the presence of different military checkpoints cutting off Ramallah and al-Bireh from the rural surroundings. The study sample included 37 dental clinics out of the 94 counted in Ramallah and al-Bireh. Thirty-one private clinics were randomly chosen from the 86 dental clinics included within the private sector. The institutional dental clinics were all included, since they were few, except for two. The dentist serving one of the NGO clinics was abroad at the time of the study. The other clinic is run by UNRWA, and is situated in al-Jalazon refugee camp, which could not be reached due to the military checkpoint there.

The first part of the questionnaire included data on country and date of graduation, gender of dentist, type of degree (Bachelor or higher degree), type of clinic, the starting date of the clinic, number of staff at the clinic, and whether the dentist or the staff were vaccinated against Hepatitis B. The last item was included due to the risks that are present for the health personnel who handle dental wastes, especially sharps, whether it was the dentist himself/herself or staff such as nurses, assistants or waste handlers. The second part of the questionnaire focused on the various types of waste that are generated by the dental offices on daily basis.

Amalgam waste questions focused on the average number and size of newly placed amalgam fillings per week, as well as the average number of the removed old amalgam fillings per week. Dentists were also asked about what type of amalgam they used, since the amalgamated capsules are much safer to use than the elemental or raw mercury amalgam, which could be subjected to accidental spills. Additional questions were concerned with the disposal of the old removed or the extra newly placed amalgam fillings.

Data was entered and analysed using the statistical program SPSS 8.0. Simple frequencies, means and cross tabs were used. Chi-square and Anova tests were utilized to test differences in

waste disposal between various observed variables such as gender of dentist, year and country of graduation, type of degree and type of clinic.

Results

The most common types of restorations used in the dental office are amalgam and composite. The composite filling is an esthetic filling used mainly for the anterior teeth. However, new brands are being gradually introduced for the restoration of posterior teeth. They are more expensive than amalgam. The majority of dentists (89.2%) said that they use both types of restorations while 10.8% confirmed that they stopped using the amalgam at all. Among those who use amalgam, 42.4% use elemental mercury amalgam, whereas 57.6% use amalgam capsules. It is worth mentioning that the elemental mercury amalgam is less expensive than the capsulated one, which could explain the fact that no significant correlation was found between the type of amalgam and the other variables like the type of clinic, country and year of graduation, age of the clinic or the gender of the dentist.

The average number of removed old amalgam fillings per week as well as the newly placed amalgam is illustrated in Table 1. This indicates that a general dental practitioner in Ramallah city places about two small, nine medium, and seven large amalgam fillings each week. With a simple calculation based on the above mentioned information from the pollution prevention agency in the Bay Area in San Francisco (Envirosense 2001), this number of fillings would produce 22.55 g of mercury from amalgam waste per week, assuming that each unit of amalgam filling releases 0.55 g of mercury.

Modes of disposal of the extra newly placed amalgam fillings are shown in Table 2. Likewise, the final destination of useless non-contact amalgam fillings is also shown in the same table. The latter fillings are usually dry or extra wet fillings due to the disproportion of the mercury with the alloy mixture of silver, tin and copper. Dentists who use elemental mercury amalgam face this kind of unwanted discarded fillings more often than their colleagues who use the capsulated amalgam.

As for the disposal of the old removed amalgam restorations, the responses of the interviewed dentists are illustrated in Table 3. The relation between the disposal of old amalgam fillings and the degree of the dentist (Bachelor or Master) was found to be significant ($P = 0.022$).

Discussion

This study included a sample of 37 dental offices from a total number of 94 located within the boundaries of Ramallah and al-Bireh cities, representing about 39.36% of all dental clinics. The

Table 1. The average number of old and new amalgam per week vs. type of clinic

	<i>NGO/Public clinics</i>	<i>Private clinics</i>	<i>Total mean</i>
Average number of removed old amalgam/week	3.4	4.13	4.03
Average number of newly placed amalgam/week	26.83	15.77	17.57

Table 2. Modes of disposal of extra newly placed and non contact amalgam

<i>How do you deal with non-contact amalgam?</i>	<i>Disposal of extra newly placed amalgam</i>		<i>Disposal of non contact amalgam</i>	
	<i>No of dentists^a</i>	<i>%</i>	<i>No of dentists</i>	<i>%</i>
Thrown in trash	18	54.5	25	75.7
In drain & trash	2	6.1	—	—
Returned to capsule then trash	9	27.3	2	6.1
Separate bottle	4	12.1	3	9.1
Down the sink	—	—	1	3
Rare ^b	—	—	2	6.1
Total	33	100	33	100

^aFour dentists of the sample (37 dentists) were excluded because they do not use amalgam. ^bRare cases who face non contact amalgam.

Table 3. Distribution of dentists by means of old amalgam disposal

<i>How do you deal with old amalgam?</i>	<i>Disposal of old amalgam</i>	
	<i>No of dentists</i>	<i>%</i>
In drain passing through coarse filter	6	16.7
Caught in filter then thrown in trash	8	22.2
Distributed between filter, drain & trash	20	55.5
Caught in vacuum filter	1	2.8
Thrown in trash	1	2.8
Total	36	100.0

study included three dentists with a Master degree out of the original number of 11 specialists who hold this degree in different dental sciences in Ramallah area. Therefore, this sample can be considered representative for the dental clinics found in the urban areas of Ramallah District.

The results showed that the economic factor played an essential role in many aspects. The use of elemental mercury amalgam instead of the safer encapsulated amalgam goes back to the fact that this type of amalgam is less expensive than the capsules, even though accidental spills can put the dental personnel at risk of mercury toxicity. In addition, many patients seem to prefer this filling to other different kinds of teeth restorations because it is not costly.

The estimated amount of mercury released from amalgam wastes for one general dental practitioner in a week is 22.6 grams of mercury. This provides a good idea about the huge mercury quantities that can be released into the environment if that number was multiplied by the total number of the scattered dentists throughout 48 working weeks in a year. This reality matches the global concern about the amounts of mercury in amalgam waste that are generated

and discharged into the environment. In the United States for instance, the American Dental Association has stated that a typical dentist removes between 700 and 800 fillings per year (DRNA 2000). Normally, the amalgam recycle companies contribute a lot to lower magnitude of mercury side effects.

In the current Palestinian situation, the majority of amalgam wastes end up in trash as well as down the drain, especially with the removal of old amalgam fillings. Nevertheless, in the absence of the above mentioned solutions, the presence of good chair side traps and following the best management practices would reduce the amounts of mercury that are generated at dental offices, thereby minimizing its negative impact on the environment.

Conclusion

The current situation shows that amalgam wastes are dumped in the general trash, which is placed in the badly controlled landfill in Ramallah city. This will lead to the evaporation of the mercury vapors into the air since garbage is being burnt on regular daily basis in an open site. Also, its presence in the landfill may lead to water and soil contamination.

Huge amounts of dental wastes are generated month after month and year after year. The accumulated effects of such environmental burdens are often overlooked. In the absence of national services and regulations, amalgam wastes will continue ending up in trash and sewer systems. Therefore, a national collaborative effort should be made to minimize the effects of solid and liquid wastes to the minimum, and to address these threats in comprehensive, effective ways. An environmentally responsible dental office can help in restoring a healthier environment and can always make a difference.

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